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The Education Papers

Carrots & Sticks:

The Effect of Recent Spending and Tax Changes on the Incentive to Attend University

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In this issue...

Measures of the effective rates of tax and subsidy summarize the extent to which governments discourage or encourage university studies. Contrary to popular wisdom, recent changes in government policy have improved the incentive to attend university relative to six years ago.

The Study in Brief

The currently dominant view of universities is that Canadian governments neglect them. University students complain that tuition fees and student debt loads are increasing rapidly, government spending per student is lower now than some years ago, and so on. This focus in public debates on postsecondary spending has eclipsed the effect of tax measures on the incentive to invest in human capital.

Changes to the personal tax system have the potential to greatly influence the return students make on university studies, and we know that significant tax changes have taken place in recent years. Overall, when considering both spending measures and tax measures, is university enrolment being encouraged or is it not? And how has the incentive changed?

It is possible to answer these questions by deriving measures of the effective tax rate and the effective subsidy rate for university studies, and then subtracting one from the other to obtain net public encouragement to university enrolment.

These calculations show that the effective subsidy rate fell only slightly between 1998 and 2003, while the effective tax rate fell substantially more. Consequently, net encouragement to university studies increased from 5.8 percent to 10.8 percent in that period.

Two recent tax changes are responsible for most of the boost in the net incentive to study: The decrease in the progressivity of the tax schedule, which the federal government introduced in 2000, and the doubling of the amount of the education tax credit in 2003. Recognizing that the form of public encouragement of university participation has changed somewhat and increased in recent years should cast new light on current debates. If governments have already increased their support for universities and students, is there really a need for further increases in subsidies? We conclude that the answer is probably no.

There is, however, room for improvement in the design of the current subsidy package. What is needed is not more, but smarter, subsidies and tax breaks.

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In recent years, investment in human capital has come to be viewed as vital for Canada's economic prosperity. Empirical evidence is mounting that human capital is linked to economic growth, and popular new economic theories suggest that it is a key element in innovation and technology adoption. It was with this growing recognition of the importance of both human capital and research that the federal government, in the late 1990s, adopted a growth strategy to promote what is known as the "knowledge-based economy." That strategy led Ottawa to introduce the Millennium Scholarship program, as well as a series of tax measures to encourage participation in higher education. It has also led to increased investment in research and graduate training at Canadian universities, as well as to greater interaction between academic researchers and the private sector.

Despite major initiatives at the federal level to encourage human capital investment, however, one often hears — from universities, students, and others — that Canadian governments are neglecting higher education. Tuition fees and student debt loads are increasing rapidly, while spending per student is failing to keep pace with levels that prevail at public universities in the United States. Yet enrollment at Canadian universities also continues to increase. What is going on? Is university enrollment being encouraged or is it not? How can one tell?

In this Commentary, we show that it is possible to answer these questions, at least in part, by updating past measurements of private and total rates of return to university education. They can be answered even more fully, however, by using some new tools that allow us to measure the assistance to education provided by both the expenditure and tax sides of the ledger.

Since the 1960s, Canadian researchers have repeatedly estimated the gap between the private rate of return to university education and the total rate of return from a public viewpoint. Our results show that, for the simplest income tax scenario (individuals with no dependents and no deductions), this gap stood at less than a single percentage point for first-degree university studies in 1998, a result that reflects only surprisingly mild encouragement of university study. In view of the large subsidies Canadian taxpayers provide both universities and students, why is the gap between total and private rates of return not wider?

We show that, in fact, the gap reflects the difference between what economists call the "effective subsidy rate" (ESR) and the "effective tax rate" (ETR) on this form of human capital investment. The key to understanding the mild net public encouragement of university study in 1998 is that, at the time, although the ESR stood at about 19 percent, the ETR was around 14 percent, which cancelled most of the boost subsidies gave to higher education. From 1998 to 2003, however, while the ESR rose slightly, to 21 percent, the ETR fell to about 10 percent, which significantly increased net public financial encouragement of university attendance.

Of the large number of tax changes that have affected human capital in recent years, two alone are responsible for most of the decline in the ETR between 1998

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and 2003: the decrease in the progressivity of the tax schedule, which the federal government introduced in 2000, and the doubling of the amount of the education tax credit in 2003. Focus in public debates on expenditures on postsecondary education has eclipsed the human capital effects of these tax changes. It is important to redress that balance.

Recognizing that public encouragement of university participation has both changed form somewhat and increased in recent years should cast new light on current debates. If governments have already increased their support for universities and students, is there really a need for further increases in subsidies? We conclude that, in aggregate terms, the answer is probably no. There is, however, room for improvement in the design of the current subsidy package. What is needed is not more, but "smarter," subsidies and tax breaks.

Rates of Return to Education

Estimates of the total and private rates of return to university education in Canada typically take into account both the costs of obtaining that education and the gain in annual earnings the individual reaps from it throughout his or her working lifetime. If costs were in the form of a lump sum amount paid in a single period and earnings gains were constant from year to year, one could calculate the private rate of return simply by dividing the amount of the earnings gain by the amount of the costs. For the private rate of return, costs would be only those borne by the individual and the earnings gain would be measured after tax. In calculating the total rate of return, however, one would need to consider both the full costs of education, not just those borne by the individual, and the before-tax earnings gain.

Of course, the returns to education are not constant over a lifetime and costs are not incurred at a single point in time; rather, both are distributed over a number of years, which requires the use of what economists call "internal rates of return" to calculate the required rates of return to education.[1]

Emery (2004) catalogues 21 earlier studies that estimate total and/or private rates of return to education, either for Canada as a whole or for a particular province. Because they use different data sources and methods, these studies have produced a wide range of estimates, which makes it difficult to discern trends over time. Emery attacks this problem by summarizing the trends in estimates over time statistically. This approach, while unconventional, is nonetheless useful as it allows him to control for some of the major differences in methods and data sources. His results, shown in Table 1, give an idea of representative estimates for selected years from 1970 to 1998. They indicate that net rates of return rose gently from 1970 to 1990, then declined somewhat, while total rates of return initially declined, then increased. The gap between these two measurements peaked at 3.9 percentage points for males and 7.2 percentage points for females in 1980. By 1998, according to Emery's summary, the gap had declined to a mere 1.6 percentage points for males and 4.9 percentage points for females.

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1 See the appendix, where we also break costs into their direct component and forgone earnings while engaged in education.

Table 1: *Rates of Return to First-Degree University Study, 1970-98*

	Males			Females		
	Net-of-Tax Private Rate of Return	Total Rate of Return	Column (1) minus Column (2)	Net-of-Tax Private Rate of Return	Total Rate of Return	Column (4) minus Column (5)
	(1)	(2)	(3)	(4)	(5)	(6)
			percent			
1970	10.7	8.3	2.4	15.0	9.3	5.7
1980	11.8	7.9	3.9	16.1	8.9	7.2
1990	12.1	8.7	3.4	16.4	9.7	6.7
1995	12.0	9.6	2.4	16.3	10.6	5.7
1998	11.8	10.2	1.6	16.1	11.2	4.9

Source: Authors' calculations from regression results of Emery (2004), appendix 2.

Although these patterns are interesting, we cannot tell from previous work how much of the decline in the gap between net and total rates of return since 1980 is due to falling subsidies and how much is the result of increased income tax burdens. This requires a decomposition of the subsidy and tax effects, to which we now turn for a comparison of the rates of return for 1998 and 2003.

Our Estimates of Rates of Return

It is impossible to calculate with certainty the rate of return to a university education for any single individual: even at the end of the person's working life and with full data on his or her education and earnings, the exercise would involve guesswork. The reason is that one would also need to know how much the individual would have earned without a university education, which could be estimated by looking at the earnings of otherwise similar people who did not go to university, but the results would obviously be subject to error. Moreover, even if it were possible to measure an individual's rate of return to education, the result would have only historical value. Instead, we want to know what social and individual rewards to education are implied by the present structure of education finance and how much today's graduates can expect to earn in the future. But how can we predict how much people will earn over their lifetimes? In the absence of a crystal ball, one can look at how much people of different ages with a given education earn now, and assume that this amount will remain fixed in the future — an imperfect procedure, but it is hard to think of a better one.[2]

To project lifetime earnings paths, we use data from Statistics Canada's 1998 Survey of Consumer Finance (SCF). For our estimates for 2003, we inflate earnings

2 It used to be common to assume that age-specific earnings would rise at a constant rate into the foreseeable future — say 1 or 2 percent per year. Over the past 15 to 20 years, however, after-tax real wages in Canada have grown very slowly.

by the real growth of weekly wages and salaries from 1998 to 2003 by gender.[3] We confine our attention to individuals who worked full time, full year, were not self-employed, and had no student loans. We take their before-tax incomes from the SCF and apply the existing federal and Ontario provincial tax codes in order to compute their personal income tax payments.[4] For simplicity, we also assume each individual is single and we ignore registered education and retirement savings plan contributions.[5] We then rank all SCF earners of a given sex within five-year age bands from highest to lowest, which allows us to trace out the lifetime earnings of an individual who was always, for example, the median earner in his or her age, gender, or education group.[6] In each case, to establish the path of lifetime earnings gain, we compare the predicted earnings of a university graduate with those of a high school graduate at the median among high school graduates.[7]

The cost of higher education has two components: foregone earnings and direct costs. As other studies have done, we assume that foregone earnings amount to two-thirds of what a full-time worker with only a high school diploma would earn. In the calculation of total and private rates of return, the difference between the before- and after-tax values of foregone earnings is small since young high school graduates earn relatively little and pay low taxes. Direct costs in the two calculations, on the other hand, differ greatly. In the calculation of the private rate of return, the direct cost of university equals the sum of tuition, activity fees, and "other direct costs" — such as those for textbooks and equipment. Living costs are not included in the calculation since they would be incurred whether or not the individual attended university. In the calculation of the public rate of return, direct costs are much larger since they include not only private costs but the amount of the subsidy to a student's education — in other words, in computing the total rate of return, direct costs should include the total cost of services the institution provides plus the student's other direct costs.

In calculating the private rate of return, tax relief for university students also must be taken into account. Students receive federal and provincial tax credits for tuition and a monthly "education amount" (currently, $400 for full-time students), both of which are creditable at the lowest marginal tax rate. Thus, for example, a student who pays $4,500 in fees and claims the education amount for eight

3 Statistics Canada replaced the SCF with the Survey of Labor Income Dynamics after 1998. The data from the latter survey are not yet available for 2003, but even if they were, their use here could obscure the impact of expenditure and tax changes. We do not want to confound the impacts of changes in fiscal variables with those in the earnings structure.

4 We use the Ontario tax system for simplicity since it may be taken as a rough average of provincial systems and since it applies (exactly) to about a third of the Canadian labour force. For provinces other than Ontario, this procedure is not exact, so in principle our estimates could be affected. However, since we overstate tax burdens in some provinces and understate them in others, we believe that our results on median rates of return are little affected.

5 These simplifications should have little effect on our results as they concern features of the tax system that were stable over the 1998-2003 period.

6 We can do the same for a male or female at the first, tenth, twenty-fifth, or any other percentile of his or her distribution; see Collins and Davies (2004).

7 This approach should provide better results, we believe, than the standard one of using log earnings regressions. One reason is that the latter impose an arbitrary functional form (generally quadratic) on the age dependence of earnings, whereas our non-parametric approach allows our age-earnings profiles to be faithful to the data.

months could receive a federal credit equal to 16 percent of $7,700, or $1,232. Provincial credits, on average, are worth about half the federal amount, so typical tax relief could total between $1,800 and $1,900 per year, which reduces the direct costs that students would otherwise face.[8] These credits thus bear a strong resemblance to cash grants for university education, although such tax relief comes after the fact, which might weaken its positive incentive. In recent years, the federal government has greatly increased its direct "grants" to students in this form even as it has effectively reduced its support for universities through grants to the provinces — an offset that has not been widely recognized.

Table 2 presents our estimates of the total and net-of-tax private rates of return for the median recipient of a bachelor's degree in 1998 and 2003.[9] Note, first, that women earn a higher rate of return than men, since their foregone earnings while at university are considerably lower than men's. The second thing to note from the table is that the private return for males rose slightly between 1998 and 2003 but remained the same for females. The increase for males is due to both a reduction in tax progressivity and the increase in tax relief for students that we noted above. In fact, the impact of these factors was greater than the figures suggest, since rates of return were also being depressed by rising tuition fees. The opposing action of higher fees is relatively more important for women, who earn less on average than men, which explains why the net-of-tax private return for females did not rise between 1998 and 2003. The third thing to note from Table 2 is that the total rate of return declined slightly for both men and women between 1998 and 2003 due to increasing real public university expenditures, which increased direct costs from the public viewpoint.

To see what has happened to the net public encouragement of university study, we can look at the gaps between private and public rates of return for men and women, shown in the last column of Table 2. These gaps are narrower than Emery's (2004) estimates for 1998 (see Table 1), the likely reason being that here we simulate the effects of a "bare bones" income tax, whereby the individuals in our sample have no dependents or deductions. This allows us to focus on the pure effects of income tax progressivity and its decline with the change in federal rates and bracket structure that occurred in 2000. In the real world, of course, people have significant deductions — for example, for registered pension and retirement savings plan (RPP and RRSP) contributions — while low- and middle-income parents receive tax relief for children, and so on, factors that reduce tax burdens and raise net-of-tax private rates of return.[10] In any event, we estimate that the

8 One might object that many students have so little income that they cannot benefit fully from these nonrefundable credits. Since 1997, however, students have been able to carry forward unused credits indefinitely. In addition, they may transfer up to $5,000 in credits annually to spouses, parents, or grandparents, who surely ought to return the benefits by helping to pay for the student's tuition or other expenses.

9 Partly because we exclude self-employment income, which is known to reduce estimated rates of return, our estimates for 1998 are a little lower than the representative rates that Emery (2004) derives from other studies. They are not, however, outside the range of previous estimates; Rathje and Emery (2002), for example, estimate that net-of-tax private returns in 1998 were as low as 5.73 percent for males and 8.98 percent for females.

10 We expect, however, that over the 1998-2003 period, the strong effects of changes to the progressivity of the income tax system would dominate even if we were to model these other tax aspects as well.

Table 2: *Private and Total Rates of Return for Median University Graduates, 1998 and 2003 Tax Systems*

	Net-of-Tax Private Rate of Return	Total Rate of Return	Column (1) minus Column (2)
	(1)	(2)	(3)
		percent	
Males			
1998	9.10	8.83	0.27
2003	9.34	8.37	0.97
Females			
1998	12.66	11.38	1.28
2003	12.66	10.95	1.71
All			
1998	10.88	10.11	0.77
2003	11.00	9.66	1.34

Source: Authors' calculations using Statistics Canada's 1998 Survey of Consumer Finance and 1998 and 2003 tax systems.

Note: "All" is a simple average of the male and female cases; the base case assumes zero RPP/RRSP contributions.

difference between the net and total rates of return, averaging across the sexes, rose by 0.57 of a percentage point between 1998 and 2003. In other words, the net impact of progressivity changes and tax measures directed specifically at students, plus changes in education subsidies, was to raise the fiscal encouragement for university participation by a small but perceptible amount over the period. Although the increase was not large, the fact that there was an increase at all may well come as a surprise to those who believe that governments reduced incentives for university study over that time.

Effective Tax and Subsidy Rates

Although, as we have seen, net public encouragement of university enrollment in Canada increased slightly between 1998 and 2003, there has also been a shift in support for such education from the expenditure (the effective subsidy rate) side to the tax side (the effective tax rate).[11]

To define the ESR and ETR, we need to use a third important rate-of-return concept, the private gross-of-tax rate of return. The private rate of return we discuss above is a net after-tax rate of return. The ETR is simply the percentage difference between the gross-of-tax and net after-tax rates of return. Thus, if the gross rate is 10 percent and the net rate is 6 percent, the ETR is 40 percent. The ESR, on the other hand, tells us the percentage by which the gross-of-tax rate of

11 So far, the amount of encouragement each side provides has received little public attention, although, in a series of papers over the past few years, we have set out the techniques for doing so. See, for example, Collins and Davies (2003, 450-55; 2004, 173-80). These papers follow the approach set out in Glenday and Davies (1990) for defining effective tax rates on personal investments, and they introduce and apply the concepts of the ESR and ETR on human capital.

return has risen above the public or total rate of return through subsidies, so that, for example, if the total rate is 4 percent and the gross rate is 10 percent, then the ESR is 60 percent. Thus, the net encouragement of university enrollment, as a percent of the gross-of-tax rate of return, is given by ESR - ETR, which, in our example, would be 60 percent - 40 percent = 20 percent. Earlier, we used the gap between the total and private (after-tax) rates of return to capture the degree of public encouragement of education. As a percentage of the gross-of-tax rate of return, that gap corresponds to ESR - ETR.

An example will make clear how we compute the two rates of return, and the ETR wedge between them. Suppose that, in 1998, on leaving high school, Alice could have taken a job that paid $30,000 per year before tax, but instead she decided to go to university for four years but also to work during the summer — that is, for one-third of each year. Over the course of her four years in university, Alice will have lost $80,000 in foregone earnings while paying, say, $20,000 ($5,000 per year) in tuition fees and other direct costs. In return for this $100,000 investment, she expected to earn an annual before-tax salary of $45,000 — in other words, she anticipated a before-tax rate of return of 15 percent on her investment.[12]

Now, suppose that, had she taken the $30,000-a-year job on graduating from high school, Alice would have paid 20 percent of her annual salary in the form of federal and provincial income tax, giving her annual earnings of $24,000.[13] Further, suppose that, having chosen instead to go to university, 20 percent of Alice's tuition and other direct costs of education were creditable for tax purposes, which would make the actual after-tax cost of her university degree only 80 percent of the $100,000 before-tax amount — in other words, the tax system will have reduced the cost of her degree to $80,000. If Alice then paid one-third of her $15,000 annual earnings gain from having gone to university in the form of income tax, the annual after-tax gain would have been $10,000 in return for the $80,000 investment. In other words, Alice will have earned a net rate of return of only 12.5 percent ($10,000/$80,000). Thus, in this example, progressivity in the income tax system reduces Alice's rate of return on university from its pre-tax value of 15 percent to 12.5 percent. That difference, a reduction of 16.7 percent, is the effective tax rate, ETR.

The example illustrates how a progressive tax system with rising marginal rates can by itself impose a significant ETR on human capital. We can extend the example to clarify how we calculate the effective subsidy rate. Suppose Alice's university sets tuition fees $10,000 below cost, in view of subsidies it receives from the provincial government. Then, the true total cost of Alice's university education would be $140,000, rather than $100,000, and her total rate of return would be $15,000/$140,000, or 10.7 percent. This figure may be compared with Alice's private before-tax rate of return of 15 percent. The subsidy thus boosts her rate of return by 4.3 percentage points, giving an ESR of 28.7 percent (4.3/15.0).

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12 If the whole investment had occurred in one year instead of four and if Alice were to live (and work) forever, the rate of return would be exactly 15 percent.

13 These numbers are meant to be realistic: in 1998, a single taxpayer with before-tax income of $30,000 would have paid $6,124 in income tax if she had had only the basic personal amount credit and had paid provincial tax equal to half of basic federal tax.

We can conclude our investigation of Alice's situation by bringing taxes back into the picture. As we saw above, taxes will have reduced her rate of return from 15 percent to 12.5 percent, so that, in the end, Alice's private rate of return, after figuring in both subsidies and taxes, was greater than the true total rate of return on her education of 10.7 percent. Thus, overall, the fiscal system has encouraged Alice to seek a university education. The effects of the ESR and ETR on Alice's rate of return can be summarized as follows:

Total rate of return (i) = 10.7 percent;
Private before-tax rate of return (ii) = 15.0 percent;
Private after-tax rate of return (iii) = 12.5 percent;
(ii — i) / ii = ESR of 28.7 percent;
(ii — iii) / ii = ETR of 16.7 percent;
ESR — ETR = 12.0 percent.

Table 3 shows the results of these above calculations for 1998 and 2003. Note that the effective tax rate dropped significantly over the period, and also that there was a marginal decline in gross-of-tax returns. Recall from Table 2 that the average total rate of return for both males and females also fell during this period. One might therefore conclude that the ESR would also have declined, but the ESR is a proportional difference, and so a drop in the numerator and denominator need not lead to a fall in their ratio. In this case, the effective subsidy rate actually rose slightly from 1998 to 2003. The bottom line is that, from 1998 to 2003, the difference between the effective subsidy rate and the effective tax rate rose, meaning that there was an increase in the net support for university study over the period.

The Marginal Effective Tax Rate as a Related Concept

The effective tax rate on human capital can be compared to the marginal effective tax rate (METR) that is often calculated for investment in physical capital.[14] METR estimates help to persuade policymakers of the need for lower and more uniform capital income taxes. This is because the estimates generally show that METRs are high and that they differ by industry, type of asset, size of firm, and the capital structure of the firm. Chen and Mintz (2005), for example, report that, in 2004, METRs ranged from 28.8 percent in manufacturing to 33.8 percent in the services sector, with an overall average of 31.3 percent.

The ETR on human capital and the METR on physical capital are similar in that both act as wedges between before- and after-tax rates of return. They differ in that the ETR we measure is for a complete educational program — that is, it is an average, rather than a marginal, effective tax rate. The ETR is normally calculated in this way because labour economists have found that there is a sizable

14 For estimates of METRs in Canada and references to earlier studies, see McKenzie, Mansour, and Brûlé (1998); see also Chen and Mintz (2003).

Table 3: *Gross Rates of Return, Effective Subsidy Rates, and Effective Tax Rates for Median University Graduates, 1998 and 2003*

	Gross-of-Tax Private Rate of Return	Effective Subsidy Rate (ESR)	Effective Tax Rate	ESR minus ETR
		percent		
Males				
1998	10.99	19.66	17.20	2.46
2003	10.60	21.06	11.87	9.18
Females				
1998	14.07	19.10	9.99	9.12
2003	13.68	19.93	7.45	12.48
All				
1998	12.53	19.38	13.60	5.79
2003	12.14	20.50	9.66	10.83

Source: Authors' calculations using Statistics Canada's 1998 Survey of Consumer Finance and 1998 and 2003 tax systems.

Note: The base case assumes students have no student loans and no dependants.

premium on the completion of a level of education — the rate of return for a year or two of university, for example, is much less than that for a complete degree.[15]

The Effect of Tuition and Spending Changes

Over the period of our study, 1998 to 2003, the mean weekly wages of male workers in Canada rose by 7.6 percent while those of female workers increased by 11.2 percent. At the same time, the consumer price index increased by 12.2 percent, so that real earnings of male workers declined almost 5 percent and those of female workers fell by about 1 percent. As we shall see below, both the private and social costs of education went up a little, with the result that, if we were to neglect

15 Although our ETR and ESR measures are close conceptually to those Mintz (2001) uses in his analysis of the burden of taxes on labour, there are, however, some differences in procedure that make direct comparison of results difficult. First, our approach is based on internal rates of return, whereas Mintz computes his ETR and ESR measures as a ratio of the present value of taxes or subsidies to the increment in lifetime earnings due to education. Second, Mintz leaves aside the effects of income tax progressivity, whereas we incorporate them in our calculations. Third, Mintz does not separate out the human capital ETR from total taxes on labour. On the subsidy side, Mintz reports an ESR of 11.5 percent, but that figure is not comparable with ours, in part because his includes all public expenditures on education — that is, through primary and secondary school as well as at the postsecondary level — while we study only the university level. A further difference is that Mintz assumes the cost of education equals the lifetime increment in earnings due to education (2001, 84n14). It is generally believed that the cost of an investment in education is significantly below the earnings increment, so that an ESR that is computed using the Mintz approach will tend to be smaller than ours, which uses direct estimates of the cost of education. Under simplifying assumptions, however, the two approaches give the same answer, and we do not believe the Mintz approach would provide substantially different estimates in the current exercise. (See Glenday and Davies [1990] for further discussion.)

Table 4: *Private and Social Annual Costs of Undergraduate University Education, 1998 and 2003*

	1998		2003	2003 Costs
	1998 $	*2003 $*	*2003 $*	*1998 = 100*
Private costs				
Tuition and activity fees	3,595	4,034	4,648	115.2
Books, equipment and other direct costs to student	1,000	1,122	1,122	100.0
Foregone after-tax earnings	11,623	13,041	13,073	100.2
Less tax relief	-1,299	-1,457	-1,809	124.1
Total private costs	14,919	16,739	17,034	101.8
Social costs				
Institutional costs	5,801	6,509	7,031	108.0
Books, equipment and other direct costs to student	1,000	1,122	1,122	100.0
Foregone before-tax earnings	13,469	15,112	14,715	97.4
Total social costs	20,270	22,743	22,868	100.6

Sources: Tuition and activity fees are from Statistics Canada, CANSIM database; books, equipment, and other direct costs are based on a survey of university web sites for 1998, and are assumed to grow at the same rate as the consumer price index over the 1998-2003 period; foregone earnings are authors' calculations from Statistics Canada's 1998 Survey of Consumer Finance, as described in the text.

Note: Foregone earnings is the midpoint between medians for males and females; tax relief is the reduction in tax through the Education Amount and Tuition tax credits.

tax effects, we should find some sagging of rates of return, particularly gross-of-tax private and total returns, in our results. (The real earnings gain to education falls along with the decline in real wages.) Declines in the gross private return and total return are just what we report in Tables 2 and 3 above. Since the behaviour of the net-of-tax rate of return is, in addition, affected significantly by tax changes, we would not necessarily expect that rate to decline.

Table 4 shows the composition of the private and social costs of education in Canada for median university students in 1998 and 2003. Looking first at private costs, we see that tuition fees rose strongly — by 29.3 percent in nominal terms and 15.2 percent in real terms. Students' other direct costs and after-tax foregone earnings (the most important component of costs) were close to constant in real terms. Over half the increase in fees was, however, offset by the increase in tax relief (in the form of tuition and education amount credits), with the result that, overall, total private costs rose only 1.8 percent from 1998 to 2003. This picture might make one wonder to what extent complaints of rising costs are really warranted. Bear in mind, however, that the figures shown in Table 4 are for median students; over the past several years, students in professional programs,

for example, have had to face increases that are much larger than those incurred by median students.

Turning to social costs, we now include in the calculation the full direct costs of education, as well as before-tax, rather than after-tax, foregone earnings. These direct costs consist of instructional costs[16] plus students' "other direct costs" of the kind we noted above. Costs of instruction are paid for partly by students, partly by the universities themselves from their own resources (such as endowed income), and partly by provincial governments through grants to the universities. Expenditures funded by the universities and government make up a subsidy to students. Note that Table 4 implies this subsidy is smaller than one might think. For example, of the $7,031 in instructional costs in 2003, the median student paid $4,648, implying a subsidy of only $2,383. Historically, Canadian university students paid a smaller fraction of the true cost of their education through fees, but over the past 20 years two things have happened. First, universities have found ways to economize — for example, by increasing the size of classes and substituting part-time instructors for tenured professors — so that real instructional expenditures per student have been falling. Second, universities have steadily increased fees in both nominal and real terms. The result of these two trends is that median students now pay, according to our estimates, about two-thirds of the cost of their education through fees.[17]

In recent years, a number of provinces have increased fees for professional and high-technology programs, a trend that received a large push when Ontario deregulated fees for its graduate and professional programs in 1998. Relative to fees for arts, the upward trend in engineering fees has been mild, but those for dentistry and medicine have been accelerating since 1990. Law program fees also increased slowly until 1998, but by 2003 had risen almost 60 percent relative to those for arts, as Table 5 shows. Indeed, although fees in 1998 were relatively uniform across programs, by 2003 the ratio between the cheapest field (education) and the most expensive (law) had widened to about two to one. Not surprisingly, the range of effective subsidy rates also increased over the period. On the other hand, effective tax rates declined in all fields, and the net encouragement of enrollment, ESR - ETR, increased across the board. Significantly, however, the increases were largest in the lowest-cost programs and smaller in law and engineering.

16 Allowing adequately for a university's research expenses and the costs of graduate education, we estimate that instructional costs amount to one-half of a university's operating costs. Our per student cost of $7,031 can be compared with a figure calculated with data from the Canadian Association of University Business Officers. The latter gives total expenditures on instructional and non-sponsored research (CAUBO 2004, table 1.4). Dividing by Statistics Canada's estimate of full-time equivalent enrollment, one gets per student spending of $8,045. Since this figure includes graduate-level instruction and non-sponsored research, it is not surprising that it is somewhat higher than our number.

17 Fees currently make up only about 50 percent of universities' total operating costs, which, however, include research and other non-instructional costs. Note also that undergraduates are cheaper to instruct than graduate students.

Table 5: *Tuition Fees, Effective Subsidy Rates, and Effective Tax Rates for University Graduates, Various Fields, 1998 and 2003*

Field	Tuition and Activity Fees	Effective Subsidy Rate (ESR)	Effective Tax Rate (ETR)	ESR minus ETR
	$		*percent*	
1998				
Arts	3,535	19.36	13.96	5.40
Commerce	3,507	18.45	14.28	4.17
Education	3,396	18.84	15.25	3.59
Engineering	3,687	17.96	14.52	3.44
Law	3,667	16.18	16.62	-0.44
Science	3,528	18.55	14.09	4.45
2003				
Arts	4,400	20.69	9.48	11.20
Commerce	4,609	19.44	9.71	9.73
Education	3,714	19.62	10.37	9.25
Engineering	5,048	18.74	9.94	8.80
Law	6,923	15.36	11.89	3.47
Science	4,566	19.61	9.58	10.03

Source: Authors' calculations as described in the text.

The Effect of Tax Changes

Our estimates assume a "bare bones" case that is designed to highlight the effects of increased tax relief for students and the decline in progressivity in the federal tax system that was introduced in 2000. As noted earlier, we assume that students are single and childless and that the taxpayer has no deductions, such as those for RPPs and RRSPs.[18] Our bare bones case also ignores some provisions of the tax system that have important effects on the ETR, since these remained essentially unchanged over the study period. The most significant of such provisions, which we discuss below, are registered education savings plans (RESPs) and their associated Canada Education Studies Grants (CESGs), introduced in 1998.

Federal Tax Changes

The increasingly generous tax treatment of students actually began in the mid-1990s. Among the measures introduced was a rise in the education amount from $80 per month in 1995 to $200 by 1998 and its extension (at a lower rate) to part-time students. Part-time students also became eligible to claim child care expense

18 The effect of such plans on effective tax rates on human capital is, however, potentially large. The reason is that taxpayers who contribute the maximum allowable amount reduce not only the effective tax that falls on their earnings gains due to education, but also the effective progressivity of the tax system. We find, for example, that if all median students in 2003 had made maximum contributions to such plans, and assuming a defined contribution RPP, the ETR would have fallen from 11.9 percent to 6.5 percent for males and from 7.5 percent to 3.7 percent for females. Since many people contribute less than their limit, however, it is likely that, in practice, the effect would have been significantly smaller.

Table 6: *Selected Changes in the Structure of the Income Tax System, 1998-2003*

	1998		2003	
Federal income tax				
Brackets and rates	*Taxable income*	*Rate*	*Taxable income*	*Rate*
	$	*percent*	*$*	*percent*
	0 - 29,590	17	0 - 32,183	16
	29,591 - 59,180	26	32,184 - 64,368	22
	59,181+	29	64,369 - 104,648	26
			104,649+	29
Surtaxes	3% on basic federal tax; 5% on tax payable above $12,500		None	
Education Amounts	Full-time: $200 per month Part-time: $60 per month		Full-time: $400 per month Part-time: $120 per month	
Provincial income tax	"Tax on tax": basic provincial tax = multiple of federal; Quebec income tax separate.		"Tax on income": taxable income same as federal, but rate structure freely chosen — ranges from flat tax in Alberta to steeply rising marginal rates in Ontario; Quebec still separate.	

deductions. Other innovations were tax-free withdrawals from RRSPs for educational investments and a tax credit on the interest on student loans.

Since the late 1990s, however, both the federal and provincial governments have made significant changes in the structure of the income tax system in order to encourage enrollment in postsecondary education; Table 6 summarizes some of these changes.

One of the most important changes was a flattening of the federal marginal tax rate structure. Before 2000, there had been three tax brackets, with marginal rates of 17, 26, and 29 percent, and, as Table 6 shows, the marginal tax rate increased sharply around the $30,000 income level. This is interesting since most of the foregone earnings of postsecondary study are below $30,000 and the income gains for higher education mostly fall in the range above $30,000. Indeed, the federal rate structure at that time seems almost to have been designed to maximize the ETR on a university education. In 2000, however, the structure was expanded to four tax brackets and the tax rate was reduced on most of the earnings gain due to university study for almost all students.

Another important change was the expansion of tuition and education amount credits. Postsecondary tuition fees are now fully creditable at the basic federal income tax rate (which was reduced from 17 percent to 16 percent in 1999). A substantial portion of the creditable amount — the value of which has increased with the upward trend in fees and stood at $5,000 in 2003 — may be transferred to a spouse, parent, or grandparent, and unused amounts may be carried forward without limit. Thus, most students eventually ought to realize the full tuition credit. The education amount, which doubled in size between 1998 and 2003, is

also creditable at the bottom federal tax rate and, since it is not linked to actual expenditures, is akin to a student grant.

In an earlier study (Collins and Davies 2004), we find that RESPs result in higher after-tax rates of return and lower ETRs. If parents contribute $2,000 per year to an RESP for 15 years at a rate of return of 5 percent, females see their after-tax rate of return rise by 16 percent, while males see theirs increase by 14 percent. ETRs also fall by 59 percent for males and by more than 100 percent for females — that is, females see their ETRs go from a positive to a negative value. Combining an RESP with a CESG, however, dramatically magnifies this incentive to pursue postsecondary education. Further, in order to spread this effect more broadly across students and income groups — a concern expressed by Milligan (2002), among others — the federal government introduced in the 2004 budget a $2,000 Canada Learning Bond for postsecondary education for children from low-income families born after 2003, and enhanced the CESG matching rate for low- and middle-income families.

Provincial Tax Changes

Until 2000, all provinces, except Quebec, which collects its income tax independently, were constrained by tax collection agreements with the federal government to levy basic personal income tax as a percentage of the basic federal tax — the so-called tax-on-tax approach. Beyond this requirement, however, provinces were free to enact their own provisions. In 2001, new federal-provincial fiscal arrangements released the provinces from the tax-on-tax approach, allowing them to levy tax as a function of federal taxable income. As a result, the provincial tax landscape began to change significantly. Some provinces have diverged from the federal structure: at one extreme is British Columbia, which now has five graduated rate brackets; at the other is Alberta, which has introduced a flat tax, thereby minimizing the effect of provincial income tax on human capital ETRs. Ontario, in contrast, has retained the three-tax-bracket structure that the federal tax system used before 2000.[19]

Policy Directions

Discussions of the economics of education funding always point out two main reasons government involvement is needed: first, the inability of students to borrow enough to finance their education since they cannot pledge their human capital as collateral and, second, the returns that society reaps over and above those that graduates receive. To these reasons should be added the risk inherent in

19 For the 2003 tax year, Ontario applied tax at a rate of 6.05 percent on taxable income between zero and $32,425, 9.15 percent on income between $32,436 and $64,871, and 11.16 percent thereafter. In addition, it applied a surtax of 20 percent on income tax payable between $3,747 and $4,727, and 56 percent thereafter. These heavy surtaxes cause the province's income tax structure to be highly progressive and increase ETRs on human capital, which leads one to wonder why the populist Progressive Conservative government that created this tax structure took a direction so different than that of its ideological cousin in Alberta.

human capital investment (see e.g. Finnie 2004) and the inability of individuals to avoid or reduce that risk very much via insurance or financial markets.

The problem of borrowing can be addressed through student loans. These need to be sufficient to fund the true cost of a university education (about $17,000 per annum for the median student in 2003, according to our estimates).[20] In a riskless world, the availability of such loans would remove the inefficiency created by students being unable to continue their education up to the point where its marginal rate of return falls to the market interest rate. In addition, adequate loans would help to provide equal access to education and resolve many equity concerns. Not all concerns could be addressed in this way, however, since students from less wealthy families might be particularly discouraged by the risk inherent in human capital investment. An awareness of the latter problem might account for much of the recent interest in income-contingent student loan plans, as well as for existing provisions in the Canada Student Loan Plan that reduce payments or principal for graduates who have low income or suffer financial difficulties.

If there were no externalities, one could check whether the effects of borrowing constraints and risk were sufficiently offset by noting if the total rate of return on university education for the representative student had been pushed down to equality with the rate of return on society's alternative investments. Studies[21] have shown that the average real rate of return on those other investments is about 10 percent and, as we have seen in this paper, estimates of the total rate of return on undergraduate university study hover around the same level. Thus, if there were no externalities to higher education, one could argue that, overall, current subsidy levels are sufficient. Improvements could be made in the treatment of individual types of students, institutions, or programs, but there would not be a need for increased total spending. In fact, if it were possible to "spend smarter," it also ought to be possible to reduce aggregate subsidies without losing anything on the efficiency front.

Externalities

Our argument suggests that whether university education is being encouraged sufficiently in Canada comes down to the question of externalities, which are often mentioned in discussions of higher education finance but hard to quantify.

Discussion of education externalities goes back as far as Adam Smith and most of the classical economists, who believed that education was important in reducing crime and disorder (see West 1965). Later writers added to the list of benefits better public health, social cohesion, the ability to vote wisely, and social and political leadership. Serious investigation of the size of these benefits, however, was long hampered by statistical problems. Many factors other than education may affect crime rates or health, for example, and only recently have empirical methods been able to sort out such factors reliably. Much recent work

20 Although space does not permit us to enter into the current debate about the Canada Student Loan Program, we agree with most observers that current loan limits are insufficient (see e.g. Finnie et al. 2004). We believe this is still true despite the increase in the ceiling for loans to $210 per week from $165 in the 2004 federal budget.

21 See Jenkins (1977) and, more recently, Burgess (2005).

appears to confirm that the anticipated benefits are real (see, for example, Lochner and Moretti 2004), but for the most part these are effects of primary and secondary schooling rather than university education.

Two externalities that a liberal university education may be regarded as playing an important role in creating are the ability to vote wisely and social and political leadership. Indeed, empirical work confirms, for example, that those with higher education are more likely to participate politically, read newspapers, and express support for free speech (see Davies 2003; Dee 2003).

About 20 years ago the discussion of education externalities began to move in a new direction under the influence of the new growth theory in economics and the revolution in information technology. Human capital and human capital externalities came under the microscope, and various avenues were proposed through which human capital could raise productivity and/or growth rates.[22] It was suggested, for example, that societies with a more educated labour force would be quicker to adopt new technologies, and that more educated workers would make their co-workers more productive, through emulation or the intentional spreading of knowledge. Perhaps more subtly, the role of highly educated workers was seen as complementary with that of university researchers. New knowledge would be transferred from the university to industry in embodied form — that is, in the bodies of graduates and especially those with advanced degrees.

Although the newly posited effects of human capital are plausible and have received some support in empirical testing, it is important to note that they are not all externalities. A firm that hires a new engineer from a top school no doubt hopes the new employee will communicate new ideas to the firm and its co-workers and assist in the adoption of new technology. In other words, the firm hopes to internalize these effects. It is only when the new ideas and technologies come to the attention of other firms or their workers that there is an external effect. Early studies that claimed to find evidence of such spillovers, typically by studying neighbourhood effects in local geographical areas, have been heavily criticized in recent years, however, and better empirical methods have shown these effects to be weak or absent (see, for example, Acemoglu and Angrist 2000; Isacsson 2005).

On the growth side, it is empirically well established that countries with higher levels of education grow faster, an observation that is considered to be strong evidence of human capital externalities. Klenow and Rodriguez-Clare (2004) further argue that there is strong evidence of international spillovers in technology. This aspect raises the question of whether one should take into account, in computing the social rate of return to human capital, benefits that "leak out" to other countries. Although the point is less pressing for training than for research, it is still of some relevance. From a selfish viewpoint, of course, such externalities should be ignored in a country's own cost-benefit analysis, which suggests a rational basis for larger countries to spend more on higher education, as they are likely to internalize a larger fraction of the benefits.

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22 For an excellent summary, see Klenow and Rodriguez-Clare (2004).

In a review of the available empirical evidence on the size of externalities to education, Davies (2003) concludes that, taking all levels of education together and without being harsh on empirical claims for externalities, they would add about four to six percentage points to the total rate of return.[23] Excluding such elements as health and crime effects, which are believed to occur primarily through elementary and secondary education, externalities would add between 2 and 4 percentage points to the total rate of return. Recognizing that we have been generous toward the claims for externalities in this calculation, this suggests that the social rate of return on undergraduate university education in Canada might be about 12 to 14 percent. On that basis, it might appear that some increased encouragement for university participation is needed. However, we are not done yet, since we must also take into account the impact of the marginal cost of public funds for a full analysis, as Constantos and West (1991) point out.

It is now standard in public economics to recognize that a dollar of public funds costs the economy more than a dollar. This is because collecting an additional dollar of tax revenue removes not only a dollar from the private economy, but typically imposes an excess burden or deadweight loss. As Dahlby (1994), for example, sets out, this excess burden ranges from a low of 5 to 10 cents for the less distortionary forms of taxation, such as payroll taxes, to a high of 60 or more cents for the most distortionary taxes, such as capital and corporate income taxes. On average, a central estimate for the marginal cost of public funds would be about $1.25 to $1.50, which reduces the benefits of any public investment. In the case of education Constantos and West (1991) estimate that it reduces the social rate of return by about one percentage point, so that our estimate of the social rate of return to university education should be reduced from 12-14 percent to 11-13 percent. Such an estimate is now getting sufficiently close to the 10 percent benchmark that it is hard to believe a large increase in subsidies for higher education is needed, especially when one considers the already-substantial increases in subsidies that have occurred during the period of our study — including, for example, new grants of up to $3,000 for low-income students in their first year — and improvements in the knowledge of how to provide subsidies to encourage greater university participation without additional cost.

We Need Smarter Loans and Subsidies

We believe there are several ways to make existing tax credits, loan plans, and subsidies more effective in stimulating university enrollment without increasing per student subsidies.[24]

First, tuition and education amount credits could be made refundable. Currently, students may carry forward these credits indefinitely or transfer them to a spouse, parent, or grandparent. These provisions ensure that eventually almost all students will generate tax expenditures equal to the full credit.

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23 Davies points out a two percentage point estimate for "externalities" in the form of higher tax payments by those with university education. This element is not, however, a true externality, and it is already included in the total rate of return to education estimated in this paper.

24 Finnie (2001) and Finnie et al. (2004) provide extensive analysis of the problems we touch on briefly here.

However, the impact of those credits in encouraging enrollment is reduced if they are delayed, and may also be reduced if the credits are transferred to relatives. It would cost little simply to deliver the full credits directly and immediately to students.

Second, tuition and education amount credits could be paid in advance. Goods and services tax credits, for example, are already paid in quarterly installments. It would not be too costly for universities to report to the Canada Revenue Agency (CRA) the fees and status (whether full or part time) of students who register for studies or to notify the CRA when students withdraw.

Third, students could be given greater certainty about the size of their grant. Currently, students do not know what portion of the loan they receive will turn out to be a grant. It would cost little to give them a definite indication at the outset and would further encourage those qualifying for such assistance (see, for example, Finnie 2001).

Fourth, imputations for parental support could be made more reasonable. Student loans are now allocated on the basis of an assessment of resources and needs. For students whose parents have middle incomes, the imputation for parental support is widely considered to be unreasonable, resulting in loan limits that are too small or an inability to qualify for loans at all. A significant number of students from such families likely end their university studies too soon (again, see Finnie 2001).[25]

Fifth, it would be cheaper and, we believe, more effective to make adequate student loans available to all students than to continue with the existing RESP system. The RESP system is now very costly, since it provides non-targeted subsidies in the form of CESGs to all participants.

Conclusion

Repeated calls for increased spending on higher education in Canada have been supported by concerns about rising tuition fees and apparently low levels of public funding. As a result, Canadians have the impression that governments are doing too little to encourage participation in university education. At the same time, however, enrollment in higher education keeps rising. Clearly, some other factors are at work here.

We argue that those factors are, first, a relative switch in government support away from institutions and toward students — evidenced by the introduction of the Canada Millennium Scholarships and other new or increased grants to students — and, second, a switch in the form of support away from expenditures and toward the tax system. Calling attention to the latter change is one of the main objectives of this paper.

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25 One can anticipate the objection that, after all, these are higher-income students, which reflects the widespread dominance of equity over efficiency concerns in the discussion of access to higher education in Canada. Yet, if a student drops out of university and is thus unable to contribute fully to the economy, gross domestic product is lost just as surely whether the student is from a high- or a low-income family. Surely, even Canadians must accept that efficiency sometimes does matter in considerations of education finance!

In part, the switch to the tax side has occurred through the rapid rise of tax credits for students, which cancelled out more than half the rise in fees for typical students over the 1998-2003 period. Other explicit tax measures, ranging from tax relief on student loan interest to generous subsidies to RESPs, have also been introduced. Support from the tax side, however, has also happened in a disguised and unappreciated form: the substantial reduction in income tax progressivity that occurred in 2000 with the sizable reduction in marginal tax rates for the middle class. This change substantially reduced the tax burden on the earnings return to higher education, and is reflected in the drop in our estimate of the effective tax rate on university education from 13.7 percent in 1998 to 9.7 percent in 2003.

The more generous treatment for education on the tax side in recent years has combined with a small increase in government grants to universities to yield a not-unimpressive increase in the net encouragement to university participation. Netting out, the effective subsidy rate to education minus the effective tax rate rose from 5.8 percent in 1998 to 10.8 percent in 2003 for the median student. Bearing in mind that these numbers do not include the effect of the package of increased grants and enhancements to student loan programs announced in the 2004 federal budget, the puzzle of the current strong demand for university enrollment seems to be at least partly resolved. Although fees have indeed been rising, universities and students have been getting sufficiently increased assistance on the government expenditure and tax sides to make it more, not less, attractive to go to university.

Particularly in view of the pro-education measures announced in the 2004 federal budget, we conclude from our results that there is no argument, on grounds of economic efficiency, for a sizable increase in subsidies to university education in Canada. On the other hand, there is certainly room for improvements in the design of tax, loan, and subsidy programs. For example, the benefits that students get from tax credits could be paid to them directly and in advance. Similarly, students could be informed at the beginning of the year exactly how much of their student loan will be a grant. And the federal government could stop paying expensive bribes to get parents to save more for their children's education. Providing a genuinely adequate student loan plan would likely be a cheaper method of achieving the same boost in university participation.

Appendix: Rates of Return and Effective Tax and Subsidy Rates

The internal rate of return (IRR) on an individual's investment in schooling can be calculated from the equation:

$$\sum_{t=1}^{T} \frac{E_t - DC_t}{(1+r_i)^{t-1}} = \sum_{t=1}^{T} \frac{E_t^*}{(1+r_i)^{t-1}}$$

(1)

where E_t refers to the earnings an individual receives in each year of the working life, conditional on deciding to attend university. E_t^* represents the earnings an individual would receive if he or she entered the labour force immediately after high school. DC_t is the direct cost of going to university (for example, tuition and fees, books, and supplies). The discount rate that equates the two sides of the equation is the IRR (r_i).

Assuming that students attend university for four years, $G_t = E_t - E_t^*$ for t = 4, ...T is the stream of earnings gains from education. Foregone earnings while in school are $FE_t = - E_t$. The full annual costs of education are $C_t = DC_t + FE_t$. These alternative symbols can be used to rewrite equation (1) in the equivalent form:

$$\sum_{t=1}^{4} \frac{DC_t + FE_t}{(1+r_i)^{t-1}} = \sum_{t=5}^{T} \frac{G_t}{(1+r_i)^{t-1}}$$

(2)

which links up nicely with our discussion in the paper.

Taking the relevant features of the tax system into account, we can compute DC_t, FE_t, and G_t on an after-tax basis. Using these new values in equation (2), we can solve for r_n, or the net-of-tax IRR. Before-tax figures are used to calculate r_g, the gross-of-tax IRR. The difference between these two numbers represents the amount by which the tax system reduces university graduates' rates of return. This gives the effective tax rate (ETR):

$$ETR = \frac{r_g - r_n}{r_g}$$

Government expenditures can be taken into account by re-defining DC_t to include instructional costs borne by universities but not passed on to students. With that change and using the before-tax versions of the other variables, equations (1) or (2) yield the total rate of return to education, r_t. This, in turn, can be used to calculate the effective subsidy rate (ESR) from:

$$ESR = \frac{r_g - r_p}{r_g}$$

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